

# HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

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**Hatchery Program:** Whatcom Creek "Winter" Steelhead Program

**Species or Hatchery Stock:** Steelhead (*Onchorynchus mykiss*)  
Kendall Creek

**Agency/Operator:** Bellingham Technical College

**Watershed and Region:** Whatcom Creek  
North Puget Sound

**Date Submitted:** March 17, 2003

**Date Last Updated:** March 14, 2003

## **SECTION 1. GENERAL PROGRAM DESCRIPTION**

### **1.1) Name of hatchery or program.**

Whatcom Creek "Winter" Steelhead Program

### **1.2) Species and population (or stock) under propagation, and ESA status.**

Kendall Creek Steelhead (*Oncorhynchus mykiss*) - not listed

### **1.3) Responsible organizations and individuals**

**Name(and title):** Earl Steele, Hatchery Manager  
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#### **Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program:**

This facility works closely with the WDFW Kendall Creek Hatchery, often sharing both labor and equipment between the two facilities.

### **1.4) Funding source, staffing level, and annual hatchery program operational costs.**

Bellingham Technical College provides the hatchery facilities through a lease with the City of Bellingham Parks Department, which owns the property. The college also provides most operational costs and provides one full-time hatchery manager and student labor. Funding for fish feed is through Aquatic Lands Enhancement Account (ALEA) funding provided to WDFW for Co-op fish production.

### **1.5) Location(s) of hatchery and associated facilities.**

Whatcom Creek Hatchery: Located at the mouth of Whatcom Creek (01.0566) at RM 0.5.

Kendall Creek Hatchery: NF Nooksack River (01.0120) RM 46 at confluence with Kendall Creek (01.0406) , Puget Sound, Washington

**1.6) Type of program.**

Isolated harvest

**1.7) Purpose (Goal) of program.**

Augmentation

The goal of this program is to provide adult fish for non-tribal recreational and tribal harvest opportunity.

**1.8) Justification for the program.**

This program will be operated to provide fish for harvest while minimizing adverse effects on listed fish. This will be accomplished in the following manner:

1. Release steelhead as smolts with expected brief freshwater residence.
2. Time of release not to coincide with out-migration of listed fish.
3. Only appropriate stock will be propagated.
4. Mark all reared fish.
5. Hatchery fish will be propagated using appropriate fish culture methods and consistent with Co-Managers Fish Health Policy and state and federal water quality standards; e.g. NPDES criteria.

**1.9) List of program “Performance Standards”.**

See below

**1.10) List of program “Performance Indicators”, designated by "benefits" and "risks."**

Performance Standards and Indicators for Puget Sound **Isolated Harvest** steelhead programs.

Performance Standard	Performance Indicator	Monitoring and Evaluation Plan
Produce adult fish for harvest	Survival and contribution rates	Monitor catch
Meet hatchery production goals	Number of juvenile fish released - <b>5, 000 Whatcom Cr.; 35,000 Samish R.</b>	Future Brood Document (FBD) and hatchery records
Manage for adequate escapement where applicable	Hatchery return rates	Hatchery return records
Minimize interactions with listed fish through proper broodstock management and mass marking. Maximize hatchery adult capture effectiveness. Use only hatchery fish	Number of broodstock collected - <b>Goal: 10-20</b>	Rack counts
	Stray Rates	Spawning guidelines
	Sex ratios	Hatchery records
	Age structure	
	Timing of adult collection/spawning - <b>December to March</b>	Spawning guidelines Hatchery records
	Adherence to spawning guidelines - <b>see section 8.3</b>	
	Total number of wild adults passed upstream - <b>all</b>	
Minimize interactions with listed fish through proper rearing and release strategies	Juveniles released as smolts	FBD and hatchery records
	Out-migration timing of listed fish / hatchery fish - <b>prior to April 15/May</b>	FBD and historic natural outmigration times
	Size and time of release - <b>5 fpp/ May release</b>	FBD and hatchery records
	Hatchery stray rates	Hatchery records (marked vs unmarked)
Maintain stock integrity and genetic diversity	Effective population size	Spawning guidelines

	Hatchery-Origin Recruit spawners	
<p>Maximize in-hatchery survival of broodstock and their progeny; and</p> <p>Limit the impact of pathogens associated with hatchery stocks, on listed fish</p>	Fish pathologists will monitor the health of hatchery stocks on a monthly basis and recommend preventative actions / strategies to maintain fish health	Co-Managers Disease Policy
	Fish pathologists will diagnose fish health problems and minimize their impact	Fish Health Monitoring Records
	Vaccines will be administered when appropriate to protect fish health	
	A fish health database will be maintained to identify trends in fish health and disease and implement fish health management plans based on findings	
	Fish health staff will present workshops on fish health issues to provide continuing education to hatchery staff.	
Ensure hatchery operations comply with state and federal water quality standards through proper environmental monitoring	NPDES compliance	Monthly NPDES records

**1.11) Expected size of program.**

**1.11.1) Proposed annual broodstock collection level (maximum number of adult fish).**

10 - 20 adult steelhead.

**1.11.2) Proposed annual fish release levels (maximum number) by life stage and location.**

Life Stage	Release Location	Annual Release Level
Eyed Eggs		
Unfed Fry		
Fry		
Yearling (smolt)	Whatcom Creek (01.0566)	5,000
	Samish R. (03.0005)	35,000

**1.12) Current program performance, including estimated smolt-to-adult survival rates, adult production levels, and escapement levels. Indicate the source of these data.**

Not available

**1.13) Date program started (years in operation), or is expected to start.**

1978, with first release spring of 1979.

**1.14) Expected duration of program.**

Ongoing

**1.15) Watersheds targeted by program.**

Whatcom Creek (01.0566)

**1.16) Indicate alternative actions considered for attaining program goals, and reasons why those actions are not being proposed.**

There are no alternative actions being considered.

**SECTION 2. PROGRAM EFFECTS ON ESA-LISTED SALMONID POPULATIONS.**

**2.1) List all ESA permits or authorizations in hand for the hatchery program.**

None.

**2.2) Provide descriptions, status, and projected take actions and levels for ESA-listed natural populations in the target area.**

**2.2.1) Description of ESA-listed salmonid population(s) affected by the program.**

**- Identify the ESA-listed population(s) that will be directly affected by the program.**

None

**- Identify the ESA-listed population(s) that may be incidentally affected by the program.**

NF Nooksack Spring Chinook

**2.2.2) Status of ESA-listed salmonid population(s) affected by the program.**

**- Describe the status of the listed natural population(s) relative to “critical” and “viable” population thresholds**

Critical and viable population thresholds under ESA have not been determined, however, the SASSI report determined the NF Nooksack spring chinook population to be "critical" and Lower Skagit mainstem / tributary fall chinook to be "depressed".

**- Provide the most recent 12 year (e.g. 1988-present) progeny-to-parent ratios, survival data by life-stage, or other measures of productivity for the listed population. Indicate the source of these data.**

NA

**-Provide the most recent 12 year (e.g. 1988-1999) annual spawning abundance estimates, or any other abundance information. Indicate the source of these data.**

NA

**-Provide the most recent 12 year (e.g. 1988-1999) estimates of annual proportions of direct hatchery-origin and listed natural-origin fish on natural spawning grounds, if known.**

Estimated NF Nooksack spring chinook hatchery-origin / natural-origin proportions since 1995.

Year	Overall Escapement	Number natural-origin
1995	230	175
1996	535	210
1997	617	121
1998	370	39
1999	892	91
2000	1242	157

**2.2.3) Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of listed fish in the target area, and provide estimated annual levels of take**

**- Describe hatchery activities that may lead to the take of listed salmonid populations in the target area, including how, where, and when the takes may occur, the risk potential for their occurrence, and the likely effects of the take.**

The release of fish as described in this HGMP could potentially result in ecological interactions with listed species. These potential ecological interactions are discussed in Section 3.5, and risk control measures are discussed in Section 10.11. Implementation of the program modifications provided in this HGMP, and the actions previously taken by the comanagers, are anticipated to contribute to the continued improvement in the abundance of listed salmonids.

**- Provide information regarding past takes associated with the hatchery program, (if known) including numbers taken, and observed injury or mortality levels for listed fish.**

None

**-Provide projected annual take levels for listed fish by life stage (juvenile and adult) quantified (to the extent feasible) by the type of take resulting from the hatchery program (e.g. capture, handling, tagging, injury, or lethal take).**

Unknown (see "take" table)

**- Indicate contingency plans for addressing situations where take levels within a given year have exceeded, or are projected to exceed, take levels described in this plan for the program.**

NA

### **SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES**

**3.1) Describe alignment of the hatchery program with any ESU-wide hatchery plan (e.g. *Hood Canal Summer Chum Conservation Initiative*) or other regionally accepted policies (e.g. the NPPC *Annual Production Review Report and Recommendations* - NPPC document 99-15). Explain any proposed deviations from the plan or policies.**

Puget Sound Salmon Management Plan

**3.2) List all existing cooperative agreements, memoranda of understanding, memoranda of agreement, or other management plans or court orders under which program operates.**

This program will be operated in accordance with a Cooperative Fish Production Agreement between Earl Steele, representing the Bellingham Technical College, and WDFW. That agreement will be consistent with the Future Brood Document and with this HGMP. This program is also consistent with the Steelhead Harvest Management MOU's developed between WDFW and the Nooksack and Lummi Tribes.

**3.3) Relationship to harvest objectives.**

**3.3.1) Describe fisheries benefiting from the program, and indicate harvest levels and rates for program-origin fish for the last twelve years (1988-99), if available.**

Whatcom Creek recreational sport fisheries. Goal is a 90% harvest rate. No known listed fish have been taken in the fishery.

**3.4) Relationship to habitat protection and recovery strategies.**

The comanagers' resource management plans for artificial production in Puget Sound are

expected to be one component of a recovery plan for Puget Sound chinook under development through the Shared Strategy process. Several important analyses have been completed, including the identification of populations of Puget Sound chinook, but further development of the plan may result in an improved understanding of the habitat, harvest, and hatchery actions required for recovery of Puget Sound chinook.

### **3.5) Ecological interactions.**

The program described in this HGMP interacts with the biotic and abiotic components of the freshwater, estuarine, and marine salmonid ecosystem through a complex web of short and longterm processes. The complexity of this web means that secondary or tertiary interactions (both positive and negative) with listed species could occur in multiple time periods, and that evaluation of the net effect can be difficult. WDFW is not aware of any studies that have directly evaluated the ecological effects of this program. Alternatively, we provide in this section a brief summary of empirical information and theoretical analyses of three types of ecological interactions, nutrient enhancement, predation, and competition, that may be relevant to this program. Recent reviews by Fresh (1997), Flagg et al. (2000), and Stockner (2003) can be consulted for additional information; NMFS (2002) provides an extensive review and application to ESA permitting of artificial production programs.

#### **Nutrient Enhancement**

Adults originating from this program that return to natural spawning areas may provide a source of nutrients in oligotrophic coastal river systems and stimulate stream productivity. Many watersheds in the Pacific Northwest appear to be nutrient-limited (Gregory et al. 1987; Kline et al. 1997) and salmonid carcasses can be an important source of marine derived nutrients (Levy 1997). Carcasses from returning adult salmon have been found to elevate stream productivity through several pathways, including: 1) the releases of nutrients from decaying carcasses has been observed to stimulate primary productivity (Wipfli et al. 1998); 2) the decaying carcasses have been found to enrich the food base of aquatic invertebrates (Mathisen et al. 1988); and 3) juvenile salmonids have been observed to feed directly on the carcasses (Bilby et al. 1996). Addition of nutrients has been observed to increase the production of salmonids (Slaney and Ward 1993; Slaney et al. 2003; Ward et al. 2003).

#### **Predation – Freshwater Environment**

Coho and steelhead released from hatchery programs may prey upon listed species of salmonids, but the magnitude of predation will depend upon the characteristic of the listed population of salmonids, the habitat in which the population occurs, and the characteristics of the hatchery program (e.g., release time, release location, number

released, and size of fish released). The site specific nature of predation, and the limited number of empirical studies that have been conducted, make it difficult to predict the predation effects of any specific hatchery program. WDFW is unaware of any studies that have empirically estimated the predation risks to listed species posed by the program described in this HGMP.

In the absence of site-specific empirical information, the identification of risk factors can be a useful tool for reviewing hatchery programs while monitoring and research programs are developed and implemented. Risk factors for evaluating the potential for significant predation include the following:

Environmental Characteristics. Water clarity and temperature, channel size and configuration, and river flow are among the environmental characteristics that can influence the likelihood that predation will occur (see SWIG (1984) for a review). The SIWG (1984) concluded that the potential for predation is greatest in small streams with flow and turbidity conditions conducive to high visibility.

Relative Body Size. The potential for predation is limited by the relative body size of fish released from the program and the size of prey. Generally, salmonid predators are thought to prey on fish approximately 1/3 or less their length (USFWS 1994), although coho salmon have been observed to consume juvenile chinook salmon of up to 46% of their total length (Pearsons et al. 1998). The lengths of juvenile migrant chinook salmon originating from natural production have been monitored in numerous watersheds throughout Puget Sound, including the Skagit River, Stillaguamish River, Bear Creek, Cedar River, Green River, Puyallup River, and Dungeness River. The average size of migrant chinook salmon is typically 40mm or less in February and March, but increases in the period from April through June as emergence is completed and growth commences (Table 3.5.1). Assuming that the prey item can be no greater than 1/3 the length of the predator, Table 3.5.1 can be used to determine the length of predator required to consume a chinook salmon of average length in each time period. The increasing length of natural origin juvenile chinook salmon from March through June indicates that delaying the release hatchery smolts of a fixed size will reduce the risks associated with predation.

**Table 3.5.1. Average length by statistical week of natural origin juvenile chinook salmon migrants captured in traps in Puget Sound watersheds. The minimum predator length corresponding to the average length of chinook salmon migrants, assuming that the prey can be no greater than 1/3 the length of the predator, are provided in the final row of the table. (NS: not sampled.)**

Watershed	Statistical Week										
	16	17	18	19	20	21	22	23	24	25	26
Skagit <sup>1</sup> 1997-2001	43.2	48.3	50.6	51.7	56.1	59.0	58.0	60.3	61.7	66.5	68.0
Stillaguamish <sup>2</sup> 2001-2002	51.4	53.5	55.7	57.8	60.0	62.1	64.2	66.4	68.5	70.6	72.8
Cedar <sup>3</sup> 1998-2000	54.9	64.2	66.5	70.2	75.3	77.5	80.7	85.5	89.7	99.0	113
Green <sup>4</sup> 2000	52.1	57.2	59.6	63.1	68.1	69.5	NS	79.0	82.4	79.4	76.3
Puyallup <sup>5</sup> 2002	NS	NS	NS	66.2	62.0	70.3	73.7	72.7	78.7	80.0	82.3
Dungeness <sup>6</sup> 1996-1997	NS	NS	NS	NS	NS	NS	NS	NS	77.9	78.8	81.8
All Systems Average Length	50.4	55.8	58.1	61.8	64.3	67.7	69.2	72.8	76.5	79.0	82.4
Minimum Predator Length	153	169	176	187	195	205	210	221	232	239	250

Sources:

<sup>1</sup> Data are from Seiler et al. (1998); Seiler et al. (1999); Seiler et al. (2000); Seiler et al. (2001), and Seiler et al. (2002)..

<sup>2</sup> Data are from regression models presented in Griffith et al. (2001) and Griffith et al. (2003).

<sup>3</sup> Data are from Seiler et al. (2003).

<sup>4</sup> Data are from Seiler et. (2002).

<sup>5</sup> Data are from Samarin and Sebastian (2002).

<sup>6</sup> Data are from Marlowe et al. (2001).

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Date of Release. The release date of juvenile fish for the program can influence the likelihood that listed species are encountered or are of a size that is small enough to be consumed. The most extensive studies of the migration timing of naturally produced juvenile chinook salmon in the Puget Sound ESU have been conducted in the Skagit River, Bear Creek, Cedar River, and the Green River. Although distinct differences are evident in the timing of migration between watersheds, several general patterns are beginning to emerge:

- 1) Emigration occurs over a prolonged period, beginning soon after enough emergence (typically January) and continuing at least until July;
- 2) Two broad peaks in migration are often present during the January through July time period; an early season peak (typically in March) comprised of relatively small chinook salmon (40-45mm), and a second peak in mid-May to June comprised of larger chinook salmon;
- 3) On average, over 80% of the juvenile chinook have migrated past the trapping locations after statistical week 23 (usually occurring in the first week of June).

**Table 3.5.2. Average cumulative proportion of the total number of natural origin juvenile chinook salmon migrants estimated to have migrated past traps in Puget Sound watersheds.**

Watershed	Statistical Week										
	16	17	18	19	20	21	22	23	24	25	26
Skagit <sup>1</sup> 1997-2001	0.61	0.64	0.68	0.73	0.76	0.78	0.83	0.86	0.90	0.92	0.94
Bear <sup>2</sup> 1999-2000	0.26	0.27	0.28	0.32	0.41	0.52	0.73	0.84	0.92	0.96	0.97
Cedar <sup>2</sup> 1999-2000	0.76	0.76	0.76	0.77	0.79	0.80	0.82	0.84	0.87	0.88	0.90
Green <sup>3</sup> 2000	0.63	0.63	0.64	0.69	0.77	0.79	0.84	0.86	0.88	0.98	1.00
All Systems Average	0.56	0.58	0.59	0.63	0.68	0.72	0.80	0.85	0.89	0.94	0.95

Sources:

<sup>1</sup> Data are from Seiler et al. (1998); Seiler et al. (1999); Seiler et al. (2000); Seiler et al. (2001), and Seiler et al. (2002)..

<sup>2</sup> Data are from Seiler et al. (2003).

<sup>3</sup> Data are from Seiler et. (2002).

Release Location and Release Type. The likelihood of predation may also be affected by the location and type of release. Other factors being equal, the risk of predation may increase with the length of time the fish released from the artificial production program are commingled with the listed species. In the freshwater environment, this is likely to be

affected by distribution of the listed species in the watershed, the location of the release, and the speed at which fish released from the program migrate from the watershed.

Coho salmon and steelhead released from western Washington artificial production programs as smolts have typically been found to migrate rapidly downstream. Data from Seiler et al. (1997; 2000) indicate that coho smolts released from the Marblemount Hatchery on the Skagit River migrate approximately 11.2 river miles day. Steelhead smolts released onstation may travel even more rapidly – migration rates of approximately 20 river miles per day have been observed in the Cowlitz River (Harza 1998). However, trucking fish to offstation release sites, particularly release sites located outside of the watershed in which the fish have been reared, may slow migrations speeds (Table 3.5.3).

**Table 3.5.3. Summary of travel speeds for steelhead smolts for several types of release strategies.**

Location	Release Type	Migration Speed (river miles per day)	Source
Cowlitz River	Smolts, onstation	21.3	Harza (1998)
Kalama River	Trucked from facility located within watershed in which fish were released.	4.4	Hulett (pers. comm.)
Bingham Creek	Trucked from facility located outside of watershed in which fish were released.	0.6	Seiler et. al. (1997)
Stevens Creek	Trucked from facility located outside of watershed in which fish were released.	0.5	Seiler et. al. (1997)
Snow Creek	Trucked from facility located outside of watershed in which fish were released.	0.4	Seiler et. al. (1997)

Number Released. Increasing the number of fish released from an artificial production program may increase the risk of predation, although competition between predators for prey may eventually limit the total consumption (Peterman and Gatto 1978).

**Predation – Marine Environment**

WDFW is unaware of any studies that have empirically estimated the predation risks to listed species posed by the program described in this HGMP. NMFS (2002) reviewed

existing information on the risks of predation in the marine environment posed by artificial production programs and concluded:

“1) Predation by hatchery fish on natural-origin smolts or sub-adults is less likely to occur than predation on fry. Coho and chinook salmon, after entering the marine environment, generally prey upon fish one-half their length or less and consume, on average, fish prey that is less than one-fifth of their length (Brodeur 1991). During early marine life, predation on natural origin chinook, coho, and steelhead will likely be highest in situations where large, yearling-sized hatchery fish encounter sub-yearling fish or fry (SIWG 1984).”

“2) However, extensive stomach content analysis of coho salmon smolts collected through several studies in marine waters of Puget Sound, Washington do not substantiate any indication of significant predation upon juvenile salmonids (Simestad and Kinney 1978).”

“3) Likely reasons for apparent low predation rates on salmon juveniles, including chinook, by larger chinook and other marine predators are described by Cardwell and Fresh (1979). These reasons included: 1) due to rapid growth, fry are better able to elude predators and are accessible to a smaller proportion of predators due to size alone; 2) because fry have dispersed, they are present in low densities relative to other fish and invertebrate prey; and 3) there has either been learning or selection for some predator avoidance.”

### **Competition**

WDFW is unaware of any studies that have empirically estimated the competition risks to listed species posed by the program described in this HGMP. Studies conducted in other areas indicate that this program is likely to pose a minimal risk of competition:

1) As discussed above, coho salmon and steelhead released from hatchery programs as smolts typically migrate rapidly downstream. The SIWG (1984) concluded that “migrant fish will likely be present for too short a period to compete with resident salmonids.”

2) NMFS (2002) noted that “..where interspecific populations have evolved sympatrically, chinook salmon and steelhead have evolved slight differences in habitat use patterns that minimize their interactions with coho salmon (Nilsson 1967; Lister and Genoe 1970; Taylor 1991). Along with the habitat differences exhibited by coho and steelhead, they also show differences in foraging behavior. Peterson (1966) and Johnston (1967) reported that juvenile coho are surface oriented and feed primarily on drifting and flying insects, while steelhead are

bottom oriented and feed largely on benthic invertebrates.”

3) Flagg et al. (2000) concluded, “By definition, hatchery and wild salmonids will not compete unless they require the same limiting resource. Thus, the modern enhancement strategy of releasing salmon and steelhead trout as smolts markedly reduces the potential for hatchery and wild fish to compete for resources in the freshwater rearing environment. Miller (1953), Hochachka (1961), and Reimers (1963), among others, have noted that this potential for competition is further reduced by the fact that many hatchery salmonids have developed different habitat and dietary behavior than wild salmonids.” Flagg et al (2000) also stated “It is unclear whether or not hatchery and wild chinook salmon utilize similar or different resources in the estuarine environment.”

4) Fresh (1997) noted that “Few studies have clearly established the role of competition and predation in anadromous population declines, especially in marine habitats. A major reason for the uncertainty in the available data is the complexity and dynamic nature of competition and predation; a small change in one variable (e.g., prey size) significantly changes outcomes of competition and predation. In addition, large data gaps exist in our understanding of these interactions. For instance, evaluating the impact of introduced fishes is impossible because we do not know which nonnative fishes occur in many salmon-producing watersheds. Most available information is circumstantial. While such information can identify where inter- or intra specific relationships may occur, it does not test mechanisms explaining why observed relations exist. Thus, competition and predation are usually one of several plausible hypotheses explaining observed results.”

## **SECTION 4. WATER SOURCE**

**4.1) Provide a quantitative and narrative description of the water source (spring, well, surface), water quality profile, and natural limitations to production attributable to the water source.**

The Whatcom Creek Hatchery uses a gravity-fed water source from Whatcom Creek.

**4.2) Indicate risk aversion measures that will be applied to minimize the likelihood for the take of listed natural fish as a result of hatchery water withdrawal, screening, or effluent discharge.**

There are no known hatchery practices that would lead to take.

## **SECTION 5. FACILITIES**

### **5.1) Broodstock collection facilities (or methods).**

Fish volunteer into the facility by way of a 12 step fish ladder rising 10 vertical feet.

### **5.2) Fish transportation equipment (description of pen, tank truck, or container used).**

NA

### **5.3) Broodstock holding and spawning facilities.**

Whatcom Creek Hatchery has 2 - 4,500 cubic foot adult holding ponds.

### **5.4) Incubation facilities.**

36 vertical stacks of trays consisting of 16 trays per stack (576 trays).

### **5.5) Rearing facilities.**

There are two tanks of 10,500 cubic feet each, measuring 60' diameter by 4' deep. Fish can also be reared in the adult holding ponds.

### **5.6) Acclimation/release facilities.**

Fish are released directly from the tanks or the holding ponds described in 5.3 and 5.5.

### **5.7) Describe operational difficulties or disasters that led to significant fish mortality.**

None.

### **5.8) Indicate available back-up systems, and risk aversion measures that will be applied, that minimize the likelihood for the take of listed natural fish that may result from equipment failure, water loss, flooding, disease transmission, or other events that could lead to injury or mortality.**

An emergency generator exists on-station to provide power to a back-up pump in case of electrical outages. Also, can turn off water to ponds and recycle within system in case of surface water quality deterioration (oil spills, etc.). Alarm system tied into hatchery managers cell phone in case of emergency.

## **SECTION 6. BROODSTOCK ORIGIN AND IDENTITY**

**Describe the origin and identity of broodstock used in the program, its ESA-listing status, annual collection goals, and relationship to wild fish of the same species/population.**

### **6.1) Source.**

Adults to be returning to the Whatcom Creek trap. In the most recent past, they have received fish from Kendall Creek and Tokul Creek which are originally Chambers Creek stock.

### **6.2) Supporting information.**

#### **6.2.1) History.**

The most recent source have been Kendall Creek and Tokul Creek, which originated as Chambers Creek stock. The 1994 broodyear steelhead came from Bogachiel, which also originated as Chambers Creek stock. Prior to 1993, the stock was identified simply as Chambers Creek stock.

#### **6.2.2) Annual size.**

No natural fish have been used in the broodstock. All hatchery broodstock have been adipose fin-clipped (20 adults).

#### **6.2.3) Past and proposed level of natural fish in broodstock.**

The level of natural fish in the broodstock is unknown.

#### **6.2.4) Genetic or ecological differences.**

The natural stock is from fish that have gone upstream or were trucked upstream by the hatchery. There was no natural steelhead in Whatcom Creek prior to releases by the hatchery.

**6.2.5) Reasons for choosing.**

Locally-adapted stock.

**6.3) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish that may occur as a result of broodstock selection practices.**

NA

**SECTION 7. BROODSTOCK COLLECTION**

**7.1) Life-history stage to be collected (adults, eggs, or juveniles).**

Adults

**7.2) Collection or sampling design.**

Adult steelhead that volunteer into the facility by way of the fish ladder described in 5.1 will be utilized for broodstock. Fish with an intact adipose fin will be released above Whatcom Creek falls.

**7.3) Identity.**

All broodstock will be identified by an adipose fin-clip.

**7.4) Proposed number to be collected:**

**7.4.1) Program goal (assuming 1:1 sex ratio for adults):**

10 - 20 adult steelhead (broodstock have not yet been collected at Whatcom Creek).

**7.4.2) Broodstock collection levels for the last 12 years (e.g. 1988-99), or the most recent years available:**

Year	Adults			Eggs	Juveniles
	Females	Males	Jacks		
1988					
1989					
1990					
1991					
1992					
1993					
1994					
1995					
1996					
1997					
1998					
1999					
2000					
2001					

**7.5) Disposition of hatchery-origin fish collected in surplus of broodstock needs.**

Excess returning adipose-fin clipped steelhead will be recycled downstream for harvest opportunity.

**7.6) Fish transportation and holding methods.**

Adult non-clipped fish are moved upstream above falls in rubber fish tubes, made from inner-tube material. Fish are held in ponds described in Section 5.

**7.7) Describe fish health maintenance and sanitation procedures applied.**

Consistent with Co-Manager's Fish Health Policy.

**7.8) Disposition of carcasses.**

Carcasses will be sold to the state-approved fish buyer or used for nutrient enhancement.

**7.9) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the broodstock collection program.**

NA

## **SECTION 8. MATING**

**Describe fish mating procedures that will be used, including those applied to meet performance indicators identified previously.**

**8.1) Selection method.**

Randomly over the entire run.

**8.2) Males.**

1 to 1 spawning when adults are available. Backup males are not anticipated to be used.

**8.3) Fertilization.**

1:1 matings (when adults are available) with eggs put in iodine solution for disease disinfection for one hour (water harden).

**8.4) Cryopreserved gametes.**

NA

**8.5) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the mating scheme.**

NA

## **SECTION 9. INCUBATION AND REARING -**

**Specify any management *goals* (e.g. “egg to smolt survival”) that the hatchery is currently operating under for the hatchery stock in the appropriate sections below. Provide data on**

the success of meeting the desired hatchery goals.

**9.1) Incubation:**

**9.1.1) Number of eggs taken and survival rates to eye-up and/or ponding.**

15,000 eggs (In 1997). 90% survival to ponding.

**9.1.2) Cause for, and disposition of surplus egg takes.**

The egg take will cease upon reaching the program goal of 15,000 eggs - no surplus eggs are anticipated.

**9.1.3) Loading densities applied during incubation.**

See Kendall Creek steelhead HGMP.

**9.1.4) Incubation conditions.**

See Kendall Creek steelhead HGMP.

**9.1.5) Ponding.**

See Kendall Creek steelhead HGMP.

**9.1.6) Fish health maintenance and monitoring.**

Consistent with Co-Manager's Fish Health Policy.

**9.1.7) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish during incubation.**

NA

**9.2) Rearing:**

**9.2.1) Provide survival rate data (*average program performance*) by hatchery life stage (fry to fingerling; fingerling to smolt) for the most recent twelve years (1988-99), or for years dependable data are available.**

NA

**9.2.2) Density and loading criteria (goals and actual levels).**

*Include density targets (lbs fish/gpm, lbs fish/ft<sup>3</sup> rearing volume, etc).*

Actual loading densities have been .16 lbs/ft<sup>3</sup>

**9.2.3) Fish rearing conditions**

*(Describe monitoring methods, temperature regimes, minimum dissolved oxygen, carbon dioxide, total gas pressure criteria (influent/effluent if available), and standard pond management procedures applied to rear fish).*

Fish are reared in surface water with temperatures ranging between 50 - 60<sup>0</sup> F.

**9.2.4) Indicate biweekly or monthly fish growth information (*average program performance*), including length, weight, and condition factor data collected during rearing, if available.**

Not available

**9.2.5) Indicate monthly fish growth rate and energy reserve data (*average program performance*), if available.**

Not available

**9.2.6) Indicate food type used, daily application schedule, feeding rate range (e.g. % B.W./day and lbs/gpm inflow), and estimates of total food conversion efficiency during rearing (*average program performance*).**

Steelhead are fed Clarke's "new age" dry diet at a feeding rate up to 1.5% B.W./day (5-6 days/week). Food conversion during rearing has been around 1.5:1.

**9.2.7) Fish health monitoring, disease treatment, and sanitation procedures.**

WDFW Fish Health Specialist monitors steelhead prior to release.

**9.2.8) Smolt development indices (e.g. gill ATPase activity), if applicable.**

NA.

**9.2.9) Indicate the use of "natural" rearing methods as applied in the program.**

NA

**9.2.10) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish under propagation.**

NA

**SECTION 10. RELEASE**

**Describe fish release levels, and release practices applied through the hatchery program.**

**10.1) Proposed fish release levels.**

Age Class	Maximum Number	Size (fpp)	R e l e a s e Date	Location
Eggs				
Unfed Fry				
Fry				
Fingerling				
Yearling	5,000 35,000	5 5	May May	Whatcom Creek Samish R.

**10.2) Specific location(s) of proposed release(s).**

**Stream, river, or watercourse:** Whatcom Cr. (01.0566), Samish R.  
(03.0005)  
**Release point:** Whatcom Cr.(RM 0.5), Samish R.  
**Major watershed:** Whatcom Cr.  
**Basin or Region:** Puget Sound

**10.3) Actual numbers and sizes of fish released by age class through the program.**

Release year	Eggs/ Fry	Unfed	Avg size	Fry	Avg size	Fingerling	Avg size	Yearling	Avg size
1988									
1989									
1990									
1991									
1992									
1993									
1994									
1995								24,333	7
1996								6,469	6
1997								8,076	6
1998								20,000	6
1999								32,247	7
2000								30,000	6
2001								35,000	6
Average								22,304	6

**10.4) Actual dates of release and description of release protocols.**

Steelhead smolts have been released in the last week of March, in April, and in the first week of May. Releases into Whatcom Creek recently have been the first week of May.

**10.5) Fish transportation procedures, if applicable.**

NA

**10.6) Acclimation procedures**

Steelhead are reared on-station for seven months entirely on Whatcom Creek water.

**10.7) Marks applied, and proportions of the total hatchery population marked, to identify**

**hatchery adults.**

All steelhead will be mass marked with an adipose-fin clip.

**10.8) Disposition plans for fish identified at the time of release as surplus to programmed or approved levels.**

Fish surplus to program goals will be released from the Kendall Creek facility and not transferred to the Whatcom Creek Hatchery.

**10.9) Fish health certification procedures applied pre-release.**

Consistent with Co-Manager's Fish Health Policy.

**10.10) Emergency release procedures in response to flooding or water system failure.**

None.

**10.11) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from fish releases.**

All yearling steelhead will be released in May to minimize the likelihood for interaction, and adverse ecological effects, to listed natural chinook salmon juveniles, which migrate seaward as sub-yearling. Chinook in the Samish River have not been identified by the Puget Sound Technical Recovery Team as a historical population in the Puget Sound ESU.

**SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS**

**11.1) Monitoring and evaluation of “Performance Indicators” presented in Section 1.10.**

**11.1.1) Describe plans and methods proposed to collect data necessary to respond to each “Performance Indicator” identified for the program.**

The comanagers conduct numerous ongoing monitor programs, including catch, escapement, marking, tagging, and fish health testing. The focus of enhanced monitoring

and evaluation programs will be on the risks posed by ecological interactions with listed species. WDFW is proceeding on four tracks:

- 1) An ongoing research program conducted by Duffy et al. (2002) is assessing the nearshore distribution, size structure, and trophic interactions of juvenile salmon, and potential predators and competitors, in northern and southern Puget Sound. Funding is provided through the federal Hatchery Scientific Review Group.
  
- 2) A three year study of the estuarine and early marine use of Sinclair Inlet by juvenile salmonids is nearing completion. The project has four objectives:
  - a) Assess the spatial and temporal use of littoral habitats by juvenile chinook throughout the time these fish are available in the inlet;
  - b) Assess the use of offshore (i.e., non-littoral) habitats by juvenile chinook;
  - c) Determine how long cohorts of juvenile chinook salmon are present in Sinclair inlet;
  - d) Examine the trophic ecology of juvenile chinook in Sinclair Inlet. This will consist of evaluating the diets of wild chinook salmon and some of their potential predators and competitors. Funding is provided by the USDD-Navy.
  
- 3) WDFW is developing the design for a research project to assess the risks of predation on listed species by coho salmon and steelhead released from artificial production programs. Questions which this project will address include:
  - a) How does trucking and the source of fish (within watershed or out of watershed) affect the migration rate of juvenile steelhead?
  - b) How many juvenile chinook salmon of natural origin do coho salmon and steelhead consume?
  - c) What is the rate of residualism of steelhead in Puget Sound rivers?

Funding needs have not yet been quantified, but would likely be met through a combination of federal and state sources.

- 4) WDFW is assisting the Hatchery Scientific Review Group in the development of a template for a regional monitoring plan. The template will provide an integrated assessment of hatchery and wild populations.

**11.1.2) Indicate whether funding, staffing, and other support logistics are available**

**or committed to allow implementation of the monitoring and evaluation program.**

See Section 11.1.1.

- 11.2) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from monitoring and evaluation activities.**

Risk aversion measures will be developed in conjunction with the monitoring and evaluation plans.

## **SECTION 12. RESEARCH**

- 12.1) Objective or purpose.**

There is currently no research being conducted using Whatcom Creek Winter Steelhead.

- 12.2) Cooperating and funding agencies.**

- 12.3) Principle investigator or project supervisor and staff.**

- 12.4) Status of stock, particularly the group affected by project, if different than the stock(s) described in Section 2.**

- 12.5) Techniques: include capture methods, drugs, samples collected, tags applied.**

- 12.6) Dates or time period in which research activity occurs.**

- 12.7) Care and maintenance of live fish or eggs, holding duration, transport methods.**

- 12.8) Expected type and effects of take and potential for injury or mortality.**

- 12.9) Level of take of listed fish: number or range of fish handled, injured, or killed by sex, age, or size, if not already indicated in Section 2 and the attached “take table” (Table 1).**

**12.10) Alternative methods to achieve project objectives.**

**12.11) List species similar or related to the threatened species; provide number and causes of mortality related to this research project.**

**12.12) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse ecological effects, injury, or mortality to listed fish as a result of the proposed research activities.**

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**SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY**

“I hereby certify that the foregoing information is complete, true and correct to the best of my knowledge and belief. I understand that the information provided in this HGMP is submitted for the purpose of receiving limits from take prohibitions specified under the Endangered Species Act of 1973 (16 U.S.C.1531-1543) and regulations promulgated thereafter for the proposed hatchery program, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or penalties provided under the Endangered Species Act of 1973.”

Name, Title, and Signature of Applicant:

Certified by \_\_\_\_\_ Date: \_\_\_\_\_



**Table 1. Estimated listed salmonid take levels by hatchery activity.**

<b>Listed species affected: Chinook ESU/Population: Puget Sound Activity: Hatchery operations</b>				
<b>Location of hatchery activity: Whatcom Creek /Kendall Creek Dates of activity: Dec/Jan-May Hatchery program operator: Bellingham Technical College</b>				
<b>Type of Take</b>	<b>Annual Take of Listed Fish By Life Stage (<i>Number of Fish</i>)</b>			
	<b>Egg/Fry</b>	<b>Juvenile/Smolt</b>	<b>Adult</b>	<b>Carcass</b>
<b>Observe or harass a)</b>				
<b>Collect for transport b)</b>				
<b>Capture, handle, and release c)</b>				
<b>Capture, handle, tag/mark/tissue sample, and release d)</b>				
<b>Removal (e.g. broodstock) e)</b>				
<b>Intentional lethal take f)</b>				
<b>Unintentional lethal take g)</b>	Unknown	Unknown		
<b>Other Take (specify) h)</b>				

- a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
- b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
- c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
- d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.
- e. Listed fish removed from the wild and collected for use as broodstock.
- f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.
- g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.
- h. Other takes not identified above as a category.